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WISSENSCHAFTLICHE KURZMITTEILUNGEN

Chronic confrontation induces behavioral changes in dominant *Tupaia belangeri*

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Dominance and its physiological consequence can be studied in male *Tupaia belangeri* submitted to different types of social stress. Under chronic confrontation not only distinct physiological differences can be observed between winners and loosers, but in addition in the loosers variations occur between the subdominant and submissive animals, in many different physiological parameters (v. Holst et al. 1983). Unfortunately, no quantitative data are available describing behavior and its possible changes that occur during chronic confrontation. In order to obtain an insight into the ethological changes during chronic social stress in *Tupaia belangeri*, the following experiments were designed:

Two adult male *Tupaia belangeri* (♂ 447, ♂ 525) were kept in separate rooms, (26 ± 1 °C, 60 ± 7 % rel. humidity) in identically equipped cages (100 × 80× 124 cm in size) with horizontally and diagonally orientated branches. Individual behavior was recorded on video tapes during the first three hours of the light phase of an artifical L:D (9 am: 9 pm) on 3 days over a period of 3 months. After this, each animal was confrontated in his home cage with a strange conspecific ("intruder") over a period of 17 days. On day 1, 2, 3, and 10 of the confrontation, behavior was recorded for three hours after the beginning of the light phase. Nineteen days after the end of the confrontation, the animal's behavior was monitored again. During the experiments, the body weight of both experimental animals and of the "intruder" was recorded daily. Thirty-five defined variables of behavior (from the categories "locomotion", "comfort-activities", "investigative-behavior", "behavior related to metabolism", "territorial-behavior", definitions according to Richarz 1976) were associated with their spatial distribution in a coordinate system drawn over the cages. A total of 48 observation hours were analysed, providing more than 210 000 units of information. According to their body weight changes, the "intruder" was classified as subdominant (mean loss 10,5 %) whereas the cage-"owners" showed a more or less stable

body weight during the confrontation, which is characteristic of dominant males (v. Holst et al. 1983).

a. General motor activity (GMA). The GMA values describe the total motor activity level of an animal and are composed of the frequencies of the various variables of behavior shown per 15-minute-interval.

Under the control situation, both animals showed a constant but individually different GMA pattern (Fig. 1a). The difference between the means of both activity levels is highly significant ($p < 0.001$, Students t-test). Under confrontation, the two animals showed different reactions. ♂ 447 decreased his GMA by about 30 % on day 1, and on days 2 and 3, his GMA remained below the control values (Fig. 1b). ♂ 525 increased his GMA about 36 % on day 1, whereas on day 2 his GMA values were within the standard deviation of the controls after 30 minutes of observation (Fig. 1c). On day 3, there was a clear reduction of GMA in comparison to the control values.

b. Marking activities. During confrontation, ♂ 447 increased his sternal marking activity compared to the control value on day 1 (441 %), decreased it on day 2 (83 %) and increased it again on day 3 (160 %), when he additionally increased his abdominal marking activity by about 174 % (Table). In comparison, ♂ 525 increased sternal (194 %) and abdominal marking (2323 %) on day 1 and reduced the frequencies of both marking forms during the following two days. On day 3, both frequencies are clearly below the control levels.

Table

Marking behavior during the control situation and the confrontation

	abs. marking frequencies				
	sternal	abdominal	urine	trip	total marking activity
♂ 447					
control					
n = 3, $\bar{x}$ ± SD	49,1 ± 11,5	15,3 ± 8,3	71,6 ± 11	17 ± 9,1	153 ± 9
confrontation					
day 1	266	12	44	0	322
day 2	90	21	18	1	130
day 3	128	42	30	1	201
♂ 525					
control					
n = 3, $\bar{x}$ ± SD	53 ± 17	2,6 ± 1,5	27 ± 11,2	1 ± 1,7	83,6 ± 4,9
confrontation					
day 1	156	63	24	0	243
day 2	71	18	2	0	91
day 3	10	1	7	0	18

c. Spatial distribution of behavior (no data shown). During the control period, both animals spent most of their time near the food dish on the cage floor or on their resting places on a branch. Both marked other branches and objects on the cage floor (food dish, sleeping box) more than their resting sites. During the confrontation, both animals spent less time near the food dish and more time resting on their specific branch. Also during this period both animals showed increased marking behavior on the resting branch, especially sternal marking. Nineteen days after the end of the confrontation, both animals still spent an increased proportion of their time resting in this position.

In this study both animals reached a dominant position. This may be due to the fact that these animals were the "owners" of the cages. According to the behavioral parameters quantitated in this study a dominant position may be achieved and maintained in different

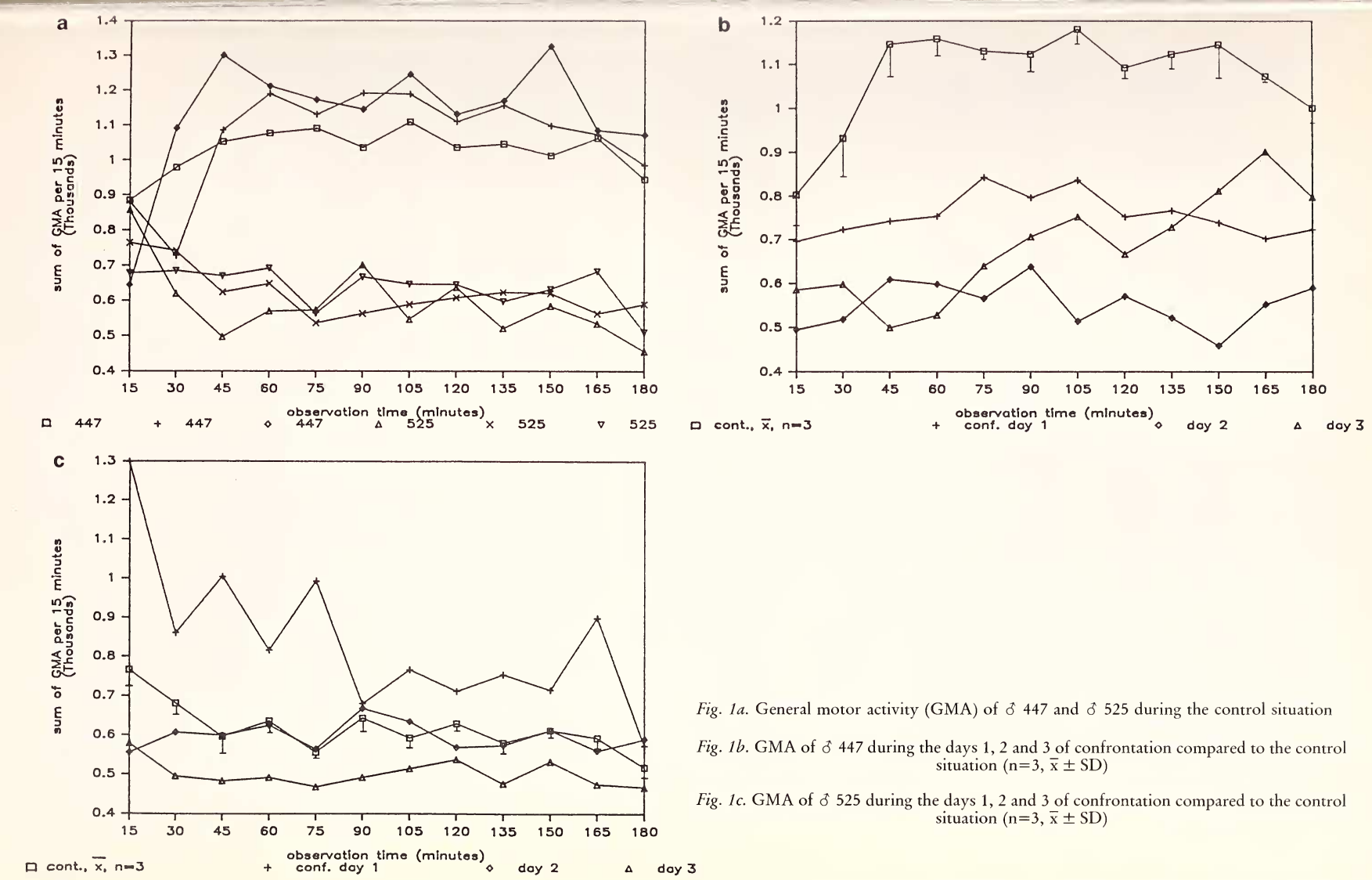

Fig. 1a. General motor activity (GMA) of ♂ 447 and ♂ 525 during the control situation

Fig. 1b. GMA of ♂ 447 during the days 1, 2 and 3 of confrontation compared to the control situation (n=3, $\bar{x} \pm SD$)

Fig. 1c. GMA of ♂ 525 during the days 1, 2 and 3 of confrontation compared to the control situation (n=3, $\bar{x} \pm SD$)

ways. The increase of marking frequency on day 1 of confrontation may be as a consequence of the presence of the fertile male conspecific. A stimulatory effect on the marking frequency by scent marks of male conspecifics was demonstrated by v. Holst and Buergel-Goodwin (1975). Scent marking does not seem to be the crucial factor in the maintenance of a dominant position as can be seen by the decreased marking frequency exhibited by ♂ 525. These results together with the data shifts in GMA and spatial distribution demonstrate that the presence of an inferior conspecific influences qualitatively and quantitatively the behavior of a dominant *Tupaia belangeri*.

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Beobachtungen zur Fortpflanzungsbiologie mediterraner Zwergfledermäuse *(Pipistrellus pipistrellus)*

Von G. Kunkel und K.-H. Taake

Eingang des Ms. 13. 11. 1985

Im Wohnhaus des im südspanischen Almeria lebenden G. K. befindet sich eine Wochenstube der Zwergfledermaus *(P. pipistrellus)*. Dieser Art gehörten folgende K.-H. T. übersandte Tiere an: ein mumifiziert im Haus gefundenes adultes ♂ sowie drei juvenile Ex., die am 8. 7. 84 moribund am Quartiereingang (kleine Maueröffnung) hingen bzw. auf der Terrasse darunter lagen. Da bei den Jungtieren die permanenten Zähne noch nicht durchgebrochen waren, übernahm Dr. H. Vierhaus (Bad Sassendorf-Lohne) freundlicherweise die Artbestimmung.

Die Zuwanderung zum Wochenstubenquartier, das im Hohlraum einer Zwischenwand gelegen ist, fand 1985 zwischen Ende April (ca. 5 ausfliegende Tiere) und Mitte Juni (108 Tiere) statt. Nach dem Flüggewerden der Jungen wurden am 3. August 301 Fledermäuse gezählt, die das Quartier innerhalb von 45 Minuten verließen (Ausflugbeginn kurz nach Sonnenuntergang). Weitere Zählergebnisse dokumentieren die saisonbedingte Auflösung der Kolonie: 11. 8.: 272 Ex., 28. 8.: 222 Ex., 14. 9.: 129 Ex., 8. 10.: 17 Ex., 22. 10.: 6 Ex.

Die am 8. 7. 84 gefundenen Jungtiere wiesen folgende Unterarmlängen auf: 12,2 – 13,8 – 20,3 mm; sie dürften demnach ein Alter von ca. 4–16 Tagen gehabt haben (vgl. Grimmberger 1982). Der Geburtszeitraum dieser Tiere ist somit ungefähr auf die Monatswende Juni/Juli zu terminieren; dies deckt sich mit den Verhältnissen in Mitteleuropa (Stebbings 1977; Grimmberger 1982; Vierhaus 1984).

Am 8. 7. 84 fand G. K. außer den drei moribunden Jungtieren ein weiteres juveniles ♀ sowie am 12. 7. 84 ein juveniles ♂, deren Größen etwa im selben Bereich wie die der drei

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